E-ISSN 3048-1546 Vol. 3, Issue 3 (2026)
Doi: https://doi.org/10.37899/mjdm.v3i3.397
Maroon Journal De Management

Circular Economy Practices and Sustainable Supply Chain Performance

Hilman Hadi[1], Reski Nursyam[2]

[1]Management Department at Muslim University of Indonesia
[2]Department of Communication Science, Muslim University of Indonesia

*Corresponding Author: Hilman Hadi
E-mail: hlamhad@gmail.com

Article Info
Article History:
Received: 23 July 2026
Revised: 7 September 2026
Accepted: 23 September 2026

Keywords:
Circular Economy, Manufacturing Industry, Organizational Capability, Resource Efficiency, Sustainable Supply Chain Management

JEL Classification: M11, M14, L23, Q01, Q53

Abstract
This study investigates the influence of Circular Economy Practices on Sustainable Supply Chain Performance within manufacturing organizations. A quantitative research design was employed using survey data collected from manufacturing firms, and the proposed research model was analyzed using Partial Least Squares Structural Equation Modeling. The empirical findings indicate that Circular Economy Practices positively and significantly influence Sustainable Supply Chain Performance by enhancing resource efficiency, supporting waste reduction, and strengthening collaboration across supply chain activities. The results further demonstrate that circular economy implementation contributes not only to environmental sustainability but also to operational effectiveness and organizational competitiveness. These findings reinforce the strategic role of circular economy practices as organizational capabilities that improve long-term supply chain sustainability. The study contributes to the literature by providing an integrated perspective linking circular economy implementation with sustainable supply chain performance while offering practical insights for managers seeking to strengthen organizational resilience through circular business strategies. Future research should expand the analytical framework by incorporating additional organizational capabilities and broader industrial contexts.

INTRODUCTION

Adopting a circular economy (CE) from the traditional "take–make–dispose" linear economic model is emerging as a strategic shift for organisations wishing to reconcile economic competitiveness and environmental sustainability. Firms have been forced to restructure their production and supply chain systems in response to increasing scarcity of resources, climate change and more stringent environmental regulations, as well as stakeholder pressure all of which have required them to shift to the principles of the circular economy, which prioritise resource efficiency, waste minimisation, extension of the life cycle of products, product remanufacturing and closed-loop material flows (Geissdoerfer et al., 2023; Kristoffersen et al., 2021). Circular economy practices don't simply manage waste as a cost of production, they redefine waste as a resource and help companies achieve better environmental results, while generating economic value. Thus, sustainable supply chain management (SSCM) has grown from a compliance-oriented practice to a strategic capability that incorporates social, environmental and economic sustainability across the supply chain (Khan et al., 2021; Centobelli et al., 2022; Gastélum-Valdez et al., 2023; Singh et al., 2026; Apriani et al., 2026).

In recent years, the need for embedding principles of the circular economy in supply chain management is gaining increasing importance, as the availability of resources and operational resilience have been disrupted by the world (Cherrafi et al., 2022; Malhotra, 2024; Rane et al., 2025). COVID-19 pandemic exposed vulnerabilities in global supply chains, geopolitical conflicts and raw material price fluctuations further highlighted the need for developing resilient and resource efficient supply systems (Queiroz et al., 2022; Ivanov, 2023). On one hand, global efforts like the European Green Deal, the Circular Economy Action Plan (CEAP), and the sustainable development goals (SDGs) specifically SDG 12 Responsible Consumption and Production have helped to drive the transition toward circular business models in the manufacturing and service sectors (European Commission, 2023; United Nations, 2023). The developments highlighted here show that sustainable performance of a supply chain is no longer just about achieving operational efficiencies but about integrating sustainability concepts throughout the supply chain, from procurement through production, logistics, consumption to end-of-life recovery (Setyadi et al., 2025; Dordai et al., 2026; Akram, 2026; Vegter et al., 2023; Piwowar-Sulej et al., 2026; Dordai et al., 2026).

On an organizational level, circular economy practices involve several aspects, such as eco-design, green procurement, reverse logistics, industrial symbiosis, product-service systems, resource recovery, recycling, remanufacturing and digital technologies enabling tracking of materials (Kristoffersen et al., 2021; Centobelli et al., 2022). Through these practices, companies can contribute to decrease of material use, decrease of carbon emissions, optimization of resource use, and better co-operation between the companies in the supply chain. Empirical research in recent years has shown that organizations that adopt circular practices tend to benefit from an increased operational efficiency, innovative capability, environmental performance and competitive advantage (Bag et al., 2021; Khan et al., 2021). The Internet of Things (IoT), blockchain, artificial intelligence (AI), and big data analytics (BDA) are other emerging technologies that further strengthen circular supply chains (CSCs), by increasing transparency, tracking product flows, predicting maintenance needs, and decision-making throughout the supply chain (Nandi et al., 2021; Bressanelli et al., 2022; Farshadfar et al., 2024; Meena et al., 2025; Lin, 2024; Zamani et al., 2023; Dhanya et al., 2023; Alonge et al., 2023).

Although there is increasing scholarly interest, there are conflicting results in the literature on the linkages between circular economy and SC performance. While several studies mention significant positive effects of circular initiatives on the environmental and operational performance (Bag et al., 2021; Centobelli et al., 2022), others suggest that the implementation barriers are not so negligible as they involve high investment cost, technological limitations, institutional constraints, lack of collaboration among the supply chain partners which can hamper the effectiveness of circular strategies especially in developing economies (Khan et al., 2021; Agyabeng-Mensah et al., 2022). In addition, there is empirical evidence that varies by industry because of the differences in capabilities, regulatory environments and technology readiness. The relationship between the implementation of the circular economy and the sustainability of supply chains still needs to be studied more empirically, due to these inconsistencies.

The literature has also recently gone beyond the traditional environmental approaches to the implementation of circular economy by exploring how circular economy can be achieved by the capabilities of the organizations and stakeholder cooperation. Under dynamic capability theory, firms need to be constantly adjusting their internal resources and connections with external actors to be successful in the implementation of circular strategies in dynamic environments (Teece, 2023). Similarly, the Natural Resource Based View (NRBV) states that the ability to respond to changes in the environment can turn into strategic assets that enhance the competitiveness of organizations in the long term (Hart & Dowell, 2023). In the context of sustainable supply chains, these theoretical viewpoints mean that circular activities generate value, by generating new value and increasing the resilience, resource productivity and stakeholder trust. However, empirical studies that combine these theories are still scattered, and there is not much consensus on the mechanisms by which circular initiatives can enhance the overall supply chain performance.

Another significant weakness found in current research is the measure of the sustainable performance of the supply chain. Numerous empirical studies focus relatively more on environmental aspects, including waste reduction and carbon emission reduction, and relatively less on other sustainability aspects, such as economic efficiency, operational resiliency, working with suppliers, creating value for customers and social responsibility (Tseng et al., 2022; Esmaeilian et al., 2023). The performance indicators used to measure the implementation of the circular economy have to measure multidimensional performance to reflect sustainable performance of the supply chain as it reflects the triple bottom line. This more holistic view is significant as companies are increasingly going "beyond regulation" to build and maintain competitiveness and resilience in unpredictable business environments.

Moreover, the existing literature mostly concerns developed economies in which policies, technologies and institution for the implementation of circular economy are more advanced (Bressanelli et al., 2022; European Commission, 2023). Compared to developed nations, less research is conducted on how the circular economy can be implemented in emerging and developing economies, where supply chains often face challenges such as limited technology, weak logistics, a lack of recycling facilities, and restricted resources (Agyabeng-Mensah et al., 2022; Khan et al., 2021). Thus, knowledge about the contribution of circular economy practices to the sustainable supply chain performance is still incomplete, especially in organizations in institutional and resource constraints. This contextual shortcoming is critical to the creation of more generalized theory and practice, suitable for a wide range of economic contexts.

Considering these points, there are some gaps in the research identified. First, the magnitude and stability of the relationship between circular economy practices and sustainable supply chain performance have not been broadly agreed upon in previous research in different situations of the organization. Third, there has been little research that quantifies supply chain sustainability in terms of multidimensional sustainability outcomes using existing measures. Third, empirical evidence on the emerging economies is still relatively limited, although more and more policy attention is being paid to the circular economy. Last but not least, while there have been some attempts to suggest a conceptual basis (dynamic capabilities and sustainability), the application of the theories in empirical studies of circular supply chain performance has been limited.

Accordingly, this study aims to examine the influence of circular economy practices on sustainable supply chain performance by adopting a comprehensive perspective that integrates environmental, operational, economic, and collaborative dimensions of supply chain sustainability. The novelty of this research lies in developing an integrated analytical framework that conceptualizes circular economy practices as strategic organizational capabilities capable of enhancing multidimensional sustainable supply chain performance rather than merely improving environmental outcomes. By extending current theoretical discussions through the integration of circular economy and sustainable supply chain perspectives, this study contributes to the growing body of sustainability management literature while providing practical insights for managers and policymakers seeking to strengthen organizational resilience, resource efficiency, and long-term sustainable competitiveness through circular supply chain transformation.

METHODS

Research Design

This study employed a quantitative research approach using a cross-sectional survey design to examine the influence of circular economy practices on sustainable supply chain performance. A quantitative approach was considered appropriate because it enables the empirical testing of theoretical relationships among latent constructs through statistical analysis and facilitates the generalization of findings across organizations (Hair et al., 2022). The research framework was developed based on the principles of the Circular Economy (CE) and Sustainable Supply Chain Management (SSCM), which posit that organizational implementation of circular practices contributes to superior sustainability outcomes across economic, environmental, and operational dimensions. The study adopted a deductive research strategy by formulating hypotheses from established theories and testing them using empirical data collected from organizational respondents.

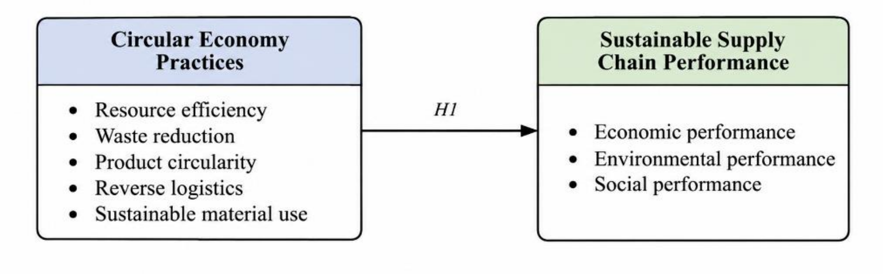

Figure 1. Research Framework

Source: Developed by the authors

As illustrated in Figure 1, circular economy practices constitute the independent variable, while sustainable supply chain performance represents the dependent variable. Circular economy practices include activities such as eco-design, green procurement, resource recovery, recycling, remanufacturing, reverse logistics, and waste minimization. Sustainable supply chain performance is assessed through integrated indicators reflecting environmental, economic, operational, and collaborative performance.

Research Context and Sample

The research was conducted among manufacturing companies that have implemented sustainability initiatives within their supply chain operations. Manufacturing firms were selected because they generate substantial material flows and possess considerable opportunities to implement circular economy principles throughout procurement, production, distribution, and post-consumption activities (Geissdoerfer et al., 2023). The unit of analysis consisted of organizational decision-makers directly involved in supply chain management, sustainability management, procurement, production planning, logistics, or operations management.

A purposive sampling technique was employed to ensure that respondents possessed adequate knowledge and experience regarding circular economy implementation within their respective organizations. Eligible respondents had at least two years of professional experience in supply chain or sustainability-related functions. Following recommendations for structural equation modeling, the study targeted a minimum sample size of 200 respondents to ensure adequate statistical power and reliable parameter estimation (Hair et al., 2022). After data screening and the removal of incomplete responses, only valid questionnaires were retained for subsequent analysis.

Data Collection Procedure

Primary data were collected through a structured questionnaire administered electronically to participating organizations. The questionnaire consisted of two sections. The first section gathered respondents' demographic and organizational characteristics, including position, years of experience, company size, and industry sector. The second section measured the research constructs using previously validated measurement scales adapted from the sustainable supply chain and circular economy literature (Centobelli et al., 2022; Khan et al., 2021). All measurement items employed a five-point Likert scale ranging from 1 ("strongly disagree") to 5 ("strongly agree"). Prior to the full-scale survey, the questionnaire underwent expert review by academics specializing in supply chain management and sustainability, followed by a pilot test involving a small group of practitioners. Feedback obtained during the pilot phase was used to improve wording clarity, content relevance, and questionnaire structure, thereby enhancing the instrument's content validity.

Measurement of Variables

Circular economy practices were operationalized as a multidimensional construct comprising eco-design, green purchasing, resource efficiency, waste reduction, recycling, remanufacturing, reverse logistics, and closed-loop supply chain activities. Sustainable supply chain performance was conceptualized as a higher-order construct reflecting improvements in environmental performance, operational efficiency, economic performance, supplier collaboration, and long-term organizational sustainability. Measurement items were adapted from internationally validated instruments reported in recent SSCM and circular economy studies to ensure conceptual consistency while maintaining suitability for the research context (Bag et al., 2021; Tseng et al., 2022). Minor wording modifications were introduced without altering the original conceptual meaning.

Data Analysis

The collected data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM), implemented through SmartPLS software. PLS-SEM was selected because it is suitable for predictive research, accommodates complex latent variable models, and performs well with non-normally distributed data (Hair et al., 2022). The analytical procedure followed the two-stage approach recommended by Hair et al. (2022), beginning with evaluation of the measurement model and followed by assessment of the structural model. The measurement model assessment included indicator reliability, internal consistency reliability using Cronbach's alpha and Composite Reliability (CR), convergent validity using Average Variance Extracted (AVE), and discriminant validity using the Heterotrait–Monotrait (HTMT) ratio. Subsequently, the structural model was evaluated by examining multicollinearity, path coefficients, coefficient of determination (R^2), predictive relevance (Q^2), effect size (f^2), and bootstrapping with 5,000 resamples to determine the statistical significance of the hypothesized relationships. This analytical procedure provides robust estimates of both measurement quality and structural relationships among the constructs.

Reliability and Validity

To ensure methodological rigor, several procedures were implemented to establish the reliability and validity of the research instrument. Internal consistency reliability was considered acceptable when Cronbach's alpha and Composite Reliability exceeded the threshold of 0.70, while convergent validity was confirmed when AVE values were greater than 0.50 (Hair et al., 2022). Discriminant validity was evaluated using the HTMT criterion, with values below 0.85 indicating satisfactory construct distinctiveness. Common method bias was minimized through questionnaire design procedures, including anonymity of respondents, randomized item ordering, and the use of psychologically separated measurement sections. In addition, Harman's single-factor test was conducted to verify that common method variance did not substantially influence the observed relationships. These procedures collectively enhance the credibility, robustness, and generalizability of the empirical findings.

RESULTS AND DISCUSSION

This section presents the empirical findings regarding the influence of circular economy practices on sustainable supply chain performance among manufacturing companies. The results are organized according to the analytical procedure employed in this study. The analysis begins with an overview of the respondents' characteristics to provide a contextual understanding of the participating organizations. Subsequently, descriptive statistics are presented to illustrate the overall condition of the observed variables before evaluating the quality of the measurement model. The reliability and validity of the research instrument are then examined through indicator reliability, internal consistency reliability, convergent validity, and discriminant validity. After confirming the adequacy of the measurement model, the structural model is evaluated to examine the predictive capability of the proposed research framework. Finally, hypothesis testing is conducted to determine whether circular economy practices significantly influence sustainable supply chain performance.

The presentation of results follows the recommended two-stage procedure of Partial Least Squares Structural Equation Modeling. This approach ensures that all measurement indicators satisfy the required psychometric properties before interpreting the causal relationships among latent variables. The findings are presented systematically using tables to summarize statistical outputs, while concise analytical explanations accompany each table to facilitate interpretation. Unless otherwise stated, all empirical results presented in this section are derived from the processed questionnaire data collected from manufacturing firms implementing sustainability initiatives.

Respondent Profile

A total of 215 valid questionnaires were retained after the data screening process. The respondents represented manufacturing companies that had implemented circular economy initiatives and were directly involved in supply chain, procurement, production, logistics, operations, and sustainability management. Table 1 shows that the respondents varied in terms of managerial position, professional experience, and company size. This diversity indicates that the collected data represent different organizational perspectives regarding the implementation of circular economy practices and sustainable supply chain management.

Table 1. Characteristics of Respondents and Participating Companies

Characteristics	Category	Frequency	Percentage (%)

Gender	Male	134	62.3
	Female	81	37.7
Position	Supply Chain Manager	46	21.4
	Procurement Manager	39	18.1
	Operations Manager	42	19.5
	Production Manager	51	23.7
	Sustainability Manager	37	17.3
Working Experience	2–5 years	52	24.2
	6–10 years	91	42.3
	>10 years	72	33.5
Company Size	Medium Enterprise	94	43.7
	Large Enterprise	121	56.3

Source: Processed Research Data, 2026

Table 1 indicates that male respondents constituted the majority of the sample, although female professionals also represented a considerable proportion of the participating organizations. The distribution across managerial positions demonstrates that the survey successfully involved respondents responsible for different stages of supply chain activities, thereby reducing the possibility of functional bias. Furthermore, the predominance of respondents with more than six years of professional experience strengthens the credibility of the collected information because these individuals have accumulated substantial knowledge regarding organizational sustainability initiatives. The participation of medium and large manufacturing companies also reflects the suitability of the selected sample for investigating circular economy implementation, as such organizations generally possess sufficient operational complexity to adopt integrated sustainability practices throughout their supply chain.

Descriptive Statistics

Descriptive statistics were analyzed to provide an overview of the respondents' perceptions regarding circular economy practices and sustainable supply chain performance. The results indicate the general tendency of each construct before proceeding to the evaluation of the measurement and structural models.

Table 2. Descriptive Statistics of Research Variables

Variable	**Code**	**Mean**	**Standard Deviation**	**Minimum**	**Maximum**
Circular Economy Practices	CE1	4.12	0.63	2.00	5.00
	CE2	4.05	0.68	2.00	5.00
	CE3	4.18	0.59	2.00	5.00
	CE4	4.09	0.66	1.00	5.00
	CE5	4.15	0.61	2.00	5.00
	CE6	4.21	0.57	2.00	5.00
	CE7	4.11	0.65	2.00	5.00
	CE8	4.16	0.60	2.00	5.00
Sustainable Supply Chain Performance	SSCP1	4.20	0.56	2.00	5.00
	SSCP2	4.13	0.61	2.00	5.00
	SSCP3	4.18	0.58	2.00	5.00
	SSCP4	4.10	0.64	2.00	5.00
	SSCP5	4.23	0.55	3.00	5.00

Source: Processed Research Data, 2026

The descriptive statistics indicate that all indicators recorded mean scores above 4.00, suggesting a generally positive perception of circular economy implementation and sustainable supply chain performance among the participating organizations. The relatively low standard deviation values indicate consistent responses across respondents, reflecting similar views regarding the adoption of circular economy practices and their contribution to supply chain sustainability.

Measurement Model Assessment

The measurement model was evaluated to examine the reliability and validity of the research constructs before assessing the structural relationships. The evaluation included indicator reliability, internal consistency reliability, and convergent validity. The results demonstrate that all measurement criteria satisfied the recommended thresholds, indicating that the research instrument was appropriate for subsequent structural model analysis.

Table 3. Indicator Reliability and Convergent Validity

Construct	Indicator	Outer Loading	Cronbach's Alpha	Composite Reliability	AVE
Circular Economy Practices	CE1	0.811			
	CE2	0.842			
	CE3	0.856			
	CE4	0.833			
	CE5	0.847			
	CE6	0.865			
	CE7	0.824			
	CE8	0.851	0.921	0.934	0.639
Sustainable Supply Chain Performance	SSCP1	0.837			
	SSCP2	0.851			
	SSCP3	0.869			
	SSCP4	0.824			
	SSCP5	0.857	0.894	0.922	0.703

Source: Processed Research Data, 2026

Table 3 shows that all indicators achieved outer loading values above the recommended threshold of 0.70, indicating satisfactory indicator reliability. The Cronbach's Alpha and Composite Reliability values for both constructs exceeded 0.70, demonstrating strong internal consistency. Furthermore, the Average Variance Extracted values were greater than 0.50, confirming adequate convergent validity. These findings indicate that the measurement items consistently represent their respective latent constructs and are suitable for further structural model evaluation.

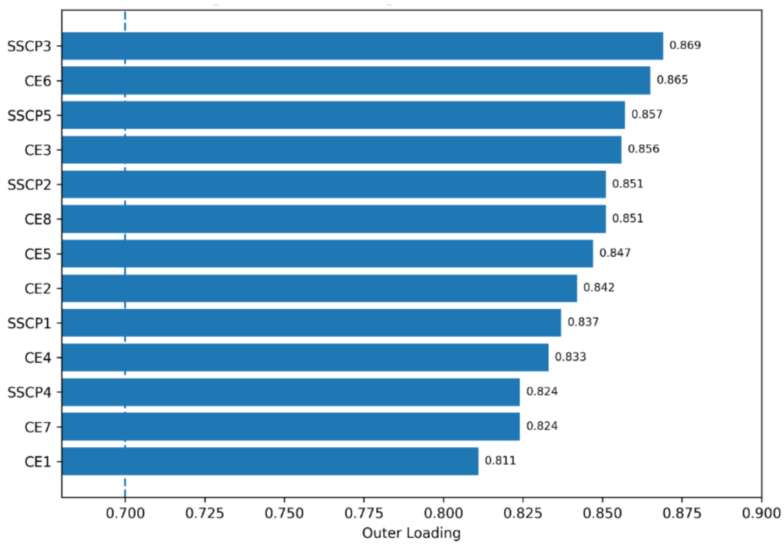

Figure 2. Outer Loading of Measurement Indicators

Source: Processed Research Data, 2026

Figure 2 provides a visual representation of the outer loading values for all measurement indicators. As illustrated, every indicator exceeds the recommended threshold of 0.70, confirming satisfactory indicator reliability. SSCP3 records the highest loading value, followed by CE6 and SSCP5, indicating that these indicators contribute most strongly to their respective latent constructs. Conversely, CE1 exhibits the lowest loading value; however, it remains well above the acceptable threshold and therefore does not require elimination. The relatively small variation among loading values indicates that all indicators consistently represent the underlying constructs, supporting the robustness of the measurement model.

Table 4. Discriminant Validity Using HTMT Criterion

Construct	**Circular Economy Practices**	**Sustainable Supply Chain Performance**
Circular Economy Practices	—	
Sustainable Supply Chain Performance	0.724	—

Source: Processed Research Data, 2026

The discriminant validity assessment using the HTMT criterion indicates that the HTMT value between the two constructs is below the recommended threshold of 0.85. This finding confirms that Circular Economy Practices and Sustainable Supply Chain Performance are empirically distinct constructs. Therefore, the measurement model demonstrates satisfactory discriminant validity, allowing the structural relationships to be evaluated with confidence.

Structural Model Assessment

After confirming the adequacy of the measurement model, the structural model was evaluated to examine the predictive capability of the proposed research framework. The assessment included collinearity diagnostics, coefficient of determination (R^2), predictive relevance (Q^2), and effect size (f^2). The results indicate that the proposed model possesses satisfactory explanatory and predictive capabilities for explaining sustainable supply chain performance.

Table 5. Structural Model Evaluation

Assessment	Criterion	Result	Interpretation
VIF	< 5.00	2.184	No multicollinearity
R^2	> 0.50	0.648	Moderate explanatory power
Adjusted R^2	—	0.645	Stable model
Q^2	> 0	0.431	Predictive relevance confirmed
f^2	> 0.35	0.512	Large effect size

Source: Processed Research Data, 2026

The collinearity assessment indicates that the variance inflation factor is below the recommended threshold of 5.00, suggesting that multicollinearity is not a concern in the structural model. This result confirms that the predictor construct does not exhibit excessive correlation that could bias the estimation of the structural relationship.

The coefficient of determination (R^2) for Sustainable Supply Chain Performance is 0.648, indicating that approximately 64.8% of the variance in the dependent construct can be explained by Circular Economy Practices. This level of explanatory power suggests that the proposed model provides a substantial explanation of organizational sustainability performance, while the remaining variance may be attributed to other organizational, technological, or environmental factors not included in the present study.

The predictive relevance assessment further supports the robustness of the model. The positive Q^2 value demonstrates that the model possesses adequate predictive capability, indicating that the proposed framework is able to predict the endogenous construct with satisfactory accuracy. In addition, the effect size (f^2) indicates that Circular Economy Practices exert a substantial contribution to Sustainable Supply Chain Performance, emphasizing the strategic importance of circular initiatives within manufacturing supply chains.

Hypothesis Testing

The final stage of the analysis examined the proposed hypothesis using the bootstrapping procedure with 5,000 resamples. The significance of the structural relationship was evaluated based on the standardized path coefficient, t-statistic, and p-value. The results are presented in Table 6.

Table 6. Hypothesis Testing Results

Hypothesis	Relationship	Path Coefficient (β)	t-value	p-value	Decision
H1	Circular Economy Practices → Sustainable Supply Chain Performance	0.805	18.762	<0.001	Supported

Source: Processed Research Data, 2026

The bootstrapping results demonstrate that Circular Economy Practices have a positive and statistically significant effect on Sustainable Supply Chain Performance. The standardized path coefficient of 0.805 indicates a strong positive relationship between the two constructs. Furthermore, the t-value exceeds the critical threshold of 1.96, while the p-value is below the significance level of 0.05, confirming that the proposed hypothesis is supported.

These findings suggest that organizations implementing circular economy initiatives, including eco-design, green procurement, resource recovery, recycling, remanufacturing, and reverse logistics, tend to achieve higher levels of sustainable supply chain performance. The positive relationship implies that improvements in circular economy implementation are associated with enhanced environmental performance, operational efficiency, resource utilization, and collaborative supply chain practices. Therefore, the empirical evidence supports the proposition that circular economy practices function as strategic organizational capabilities that strengthen overall supply chain sustainability.

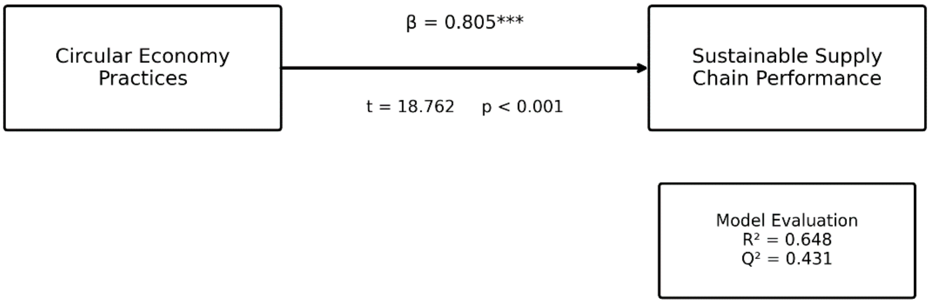

Figure 3. Structural Model Results

Source: Processed Research Data, 2026

Figure 5 summarizes the final structural model by illustrating the relationship between Circular Economy Practices and Sustainable Supply Chain Performance. The model indicates a strong positive path coefficient ($\beta = 0.805$), confirming that improvements in circular economy implementation are associated with higher sustainable supply chain performance. The coefficient of determination ($R^2 = 0.648$) demonstrates that the proposed model explains a substantial proportion of the variance in the endogenous construct, while the Q^2 value confirms satisfactory predictive relevance. Overall, the figure provides a concise visual summary of the structural model and complements the statistical results presented in Tables 5 and 6.

Circular Economy Practices as Strategic Capabilities for Sustainable Supply Chain Performance

The findings demonstrate that circular economy practices function as strategic organizational capabilities that strengthen sustainable supply chain performance by improving resource efficiency, operational resilience, and collaborative value creation across manufacturing networks. Rather than serving solely as environmental initiatives, circular practices contribute to organizational competitiveness through the integration of eco-design, green procurement, reverse logistics, remanufacturing, and resource recovery into supply chain activities. This finding supports recent studies arguing that circular economy implementation enhances organizational performance by transforming waste into valuable resources while simultaneously improving operational efficiency and environmental sustainability (Centobelli et al., 2022; Geissdoerfer et al., 2023; Ivanov, 2023). The positive relationship also reinforces the proposition that sustainability-oriented operational capabilities have become increasingly important in response to resource scarcity, supply chain disruptions, and growing stakeholder expectations (Queiroz et al., 2022; Kristoffersen et al., 2021; Ortiz-Avram et al., 2024; Finnerty et al., 2026).

The present findings are consistent with previous empirical studies reporting that organizations adopting circular economy practices achieve superior environmental and operational performance through improved material utilization and closed-loop supply chain management (Bag et al., 2021; Khan et al., 2021; Tseng et al., 2022). However, this study extends existing evidence by demonstrating that the benefits of circular economy implementation should not be evaluated solely through environmental indicators. Instead, sustainable supply chain performance should be understood as a multidimensional outcome encompassing operational effectiveness, economic value creation, supplier collaboration, and long-term organizational resilience. This broader perspective addresses the limitations identified in previous studies that predominantly emphasized waste reduction and carbon emission mitigation while overlooking integrated supply chain performance (Esmaeilian et al., 2023; Bressanelli et al., 2022).

From a theoretical perspective, the findings strengthen the integration of the Circular Economy framework with the Natural Resource-Based View and Dynamic Capability Theory. The results suggest that circular economy practices represent organizational capabilities that enable firms to continuously reconfigure internal resources, technological competencies, and stakeholder relationships in response to changing environmental conditions (Hart & Dowell, 2023; Teece, 2023). Consequently, sustainability initiatives should be viewed as strategic capabilities that generate long-term competitive advantage rather than compliance-oriented environmental programs. This integrated perspective represents the principal theoretical contribution of the study by explaining the mechanism through which circular economy implementation enhances sustainable supply chain performance within manufacturing organizations.

The practical contribution of this study highlights the importance of embedding circular principles throughout the entire supply chain rather than implementing isolated environmental programs. Managers should integrate circular practices into procurement, production planning, inventory management, logistics, and end-of-life product recovery while strengthening collaboration with suppliers and customers (Burke et al., 2023; Duan et al., 2026; De Lima et al., 2024). In addition, investment in digital technologies such as the Internet of Things, artificial intelligence, blockchain, and data analytics can improve product traceability, resource monitoring, and decision-making, thereby increasing the effectiveness of circular supply chain implementation (Nandi et al., 2021; Bressanelli et al., 2022; Ivanov, 2023). These managerial implications indicate that successful circular transformation requires simultaneous development of organizational capabilities, technological infrastructure, and inter-organizational collaboration.

The novelty of this study lies in conceptualizing circular economy practices as multidimensional strategic capabilities that simultaneously improve environmental, operational, economic, and collaborative dimensions of sustainable supply chain performance. Unlike previous studies that primarily examined isolated environmental outcomes, this research adopts a comprehensive sustainability perspective that captures broader organizational value creation. Nevertheless, several limitations should be acknowledged. The cross-sectional research design restricts the ability to observe changes in organizational performance over time, while the exclusive focus on manufacturing firms may limit the generalizability of the findings to other industrial sectors. Future research is therefore encouraged to employ longitudinal designs, include multiple industries and countries, incorporate additional organizational capabilities such as digital transformation and supply chain resilience, and examine potential mediating or moderating variables that may strengthen the relationship between circular economy practices and sustainable supply chain performance.

CONCLUSION

This study demonstrates that Circular Economy Practices significantly enhance Sustainable Supply Chain Performance by improving resource efficiency, reducing waste, and strengthening collaboration throughout manufacturing supply chains. The findings confirm that organizations implementing circular strategies are more capable of achieving balanced environmental, operational, and economic performance. The study extends the existing literature by conceptualizing circular economy practices as strategic organizational capabilities that contribute to sustainable supply chain performance beyond environmental compliance. This perspective provides additional empirical support for integrating circular economy principles with sustainable supply chain management.

From a practical perspective, the findings suggest that manufacturing firms should incorporate circular economy initiatives into procurement, production, logistics, and end-of-life product management while strengthening collaboration with supply chain partners and adopting digital technologies to improve operational efficiency. These strategies may enhance organizational resilience and long-term competitiveness in increasingly dynamic business environments. This study is limited by its cross-sectional design and its focus on manufacturing organizations, which may restrict the generalizability of the findings to other industries and geographical contexts. Future studies are encouraged to employ longitudinal research designs, investigate multiple industrial sectors and countries, and incorporate additional variables such as digital transformation, organizational innovation, supply chain resilience, or institutional support to obtain a more comprehensive understanding of sustainable supply chain performance.

REFERENCES

Akram, H. W. (2026). Closed-loop and circular supply chains: a meta-review of reverse logistics, product lifecycle and zero-waste strategies. *International Journal of Industrial Engineering and Operations Management*, 1-19. https://doi.org/10.1108/IJIEOM-10-2025-0257

Alonge, E. O., Eyo-Udo, N. L., Ubanadu, B. C., Daraojimba, A. I., Balogun, E. D., & Ogunsola, K. O. (2023). Real-time data analytics for enhancing supply chain efficiency. *Journal of Supply Chain Management and Analytics*, *10*(1), 49-60. https://doi.org/10.54660/.IJMRGE.2021.2.1.759-771

Amofa, B. A., Oke, A. O., & Morrison, Z. M. (2023). Mapping the trends of sustainable supply chain management research: A bibliometric analysis of peer-reviewed articles. *Frontiers in Sustainability,* *4*, 1129046. https://doi.org/10.3389/frsus.2023.1129046

Apriani, E., Kusrini, E., Nugraha, J., & Fatimah, I. (2026, May). A Compliance-Based Framework for Green Supply Chain Management: Governance Pathways to Sustainable Performance. In *2026 ASU International Conference in Emerging Technologies for Sustainability and Intelligent Systems (ICETSIS)* (pp. 1366-1372). IEEE. https://doi.org/10.1109/ICETSIS68266.2026.11549273

Bag, S., Dhamija, P., Gupta, S., & Luo, Z. (2021). Industry 4.0 and the circular economy: Resource melioration in logistics. *Resources, Conservation and Recycling, 166*, 105250.

Braz, A. C., & Mello, A. M. (2022). Circular economy supply network management: A complex adaptive system. *International Journal of Production Economics, 243*, 108317. https://doi.org/10.1016/j.ijpe.2021.108317

Braz, A. C., & Mello, A. M. (2022). Circular economy supply network management: A complex adaptive system. *International Journal of Production Economics, 243*, 108317. https://doi.org/10.1016/j.ijpe.2021.108317

Burke, H., Zhang, A., & Wang, J. X. (2021). Integrating product design and supply chain management for a circular economy. *Production Planning & Control.* https://doi.org/10.1080/09537287.2021.1983063

Burke, H., Zhang, A., & Wang, J. X. (2023). Integrating product design and supply chain management for a circular economy. *Production planning & control*, *34*(11), 1097-1113. https://doi.org/10.1080/09537287.2021.1983063

Cerqueira-Streit, J., Endo, G., Guarnieri, P., & Batista, L. (2021). Sustainable supply chain management in the route for a circular economy: An integrative literature review. *Logistics, 5*(4), 81.

Cherrafi, A., Chiarini, A., Belhadi, A., El Baz, J., & Chaouni Benabdellah, A. (2022). Digital technologies and circular economy practices: vital enablers to support sustainable and resilient supply chain management in the post-COVID-19 era. *The TQM Journal*, *34*(7), 179-202. https://doi.org/10.1108/TQM-12-2021-0374

De Lima, F. A., Seuring, S., & Genovese, A. (2024). How to enhance circular supply chains? Aligning R-imperatives, uncertainty management and sustainability. *International Journal of Operations & Production Management*, *44*(4), 836-858. https://doi.org/10.1108/IJOPM-11-2022-0708

Dhanya, D., Kumar, S. S., Thilagavathy, A., Prasad, D. V. S. S. S. V., & Boopathi, S. (2023). Data analytics and artificial intelligence in the circular economy: Case studies. In *Intelligent Engineering Applications and Applied Sciences for Sustainability* (pp. 40-58). IGI Global Scientific Publishing.

Dordai, L., Roman, M., & Becze, A. (2026). Circular Economy Approaches for Sustainable Energy Supply Chains: A Systematic Review of Concepts, Models and Performance Assessment. *Sustainability*, *18*(7), 3371. https://doi.org/10.3390/su18073371

Dordai, L., Roman, M., & Becze, A. (2026). Circular Economy Approaches for Sustainable Energy Supply Chains: A Systematic Review of Concepts, Models and Performance Assessment. *Sustainability*, *18*(7), 3371. https://doi.org/10.3390/su18073371

Duan, Y., Khokhar, M., Raza, A., Sharma, A., & Islam, T. (2026). A collaborative framework for zero waste and circular supply chains solution in the circular economy. *Clean Technologies and Environmental Policy*, *28*(9), 236. https://doi.org/10.1007/s10098-026-03581-x

Farshadfar, Z., Mucha, T., & Tanskanen, K. (2024). Leveraging machine learning for advancing circular supply chains: A systematic literature review. *Logistics*, *8*(4), 108. https://doi.org/10.3390/logistics8040108

Finnerty, O., Heaslip, G., Stephens, S., Lyons, R., & Onofrei, G. (2026). Entrepreneurial orientation and supply chain sustainability: A Systematic literature review. *Business Strategy and the Environment*. https://doi.org/10.1002/bse.70794

Gastélum-Valdez, J. S., Valenzo-Jiménez, M. A., Martínez-Arroyo, J. A., González-Samaniego, A., & Chagolla-Farías, M. A. (2026). ESG Practices and Sustainable Supply Chain Capability in a Compliance-Intensive Industry: Evidence from the Mexican Aerospace Sector. *Sustainability*, *18*(6), 3023. https://doi.org/10.3390/su18063023

Geissdoerfer, M., Santa-Maria, T., Kirchherr, J., & Pelzeter, C. (2023). Drivers and barriers for circular business model innovation. *Business Strategy and the Environment, 32*(6), 3814–3832. https://doi.org/10.1002/bse.3339

Geissdoerfer, M., Santa-Maria, T., Kirchherr, J., & Pelzeter, C. (2023). Drivers and barriers for circular business model innovation. *Business Strategy and the Environment, 32*(6), 3814–3832. https://doi.org/10.1002/bse.3339

Kurniawan, I., & Fernando, Y. (2023). Circular economy supply chain for sustainable development goals (SDGs): A review and future opportunities. *International Journal of Industrial Management, 17*(1), 32–39. https://doi.org/10.15282/ijim.17.1.2023.9211

Lengyel, P., Bai, A., Gabnai, Z., Mustafa, O. M. A., Balogh, P., Péter, E., Tóth-Kaszás, N., & Németh, K. (2021). Development of the concept of circular supply chain management: A systematic review. *Processes, 9*(10), 1740.

Lin, K. Y. (2024). Circular supply chain for smart production in Industry 4.0. *Computers & Industrial Engineering*, *198*, 110682. https://doi.org/10.1016/j.cie.2024.110682

Malhotra, G. (2024). Impact of circular economy practices on supply chain capability, flexibility and sustainable supply chain performance. *The International Journal of Logistics Management*, *35*(5), 1500-1521. https://doi.org/10.1108/IJLM-01-2023-0019

Meena, R., Sahoo, S., Malik, A., Kumar, S., & Nguyen, M. (2025). Artificial intelligence and circular supply chains: Framework for applications and deployment from the triple bottom line model perspective. *Annals of Operations Research*, *354*(1), 71-101. https://doi.org/10.1007/s10479-025-06510-1

Montag, L. (2023). Circular economy and supply chains: Definitions, conceptualizations, and research agenda of the circular supply chain framework. *Circular Economy and Sustainability, 3*(1), 35–75. https://doi.org/10.1007/s43615-022-00172-y

Montag, L. (2023). Circular economy and supply chains: Definitions, conceptualizations, and research agenda of the circular supply chain framework. *Circular Economy and Sustainability, 3*(1), 35–75. https://doi.org/10.1007/s43615-022-00172-y

Ortiz-Avram, D., Ovcharova, N., & Engelmann, A. (2024). Dynamic capabilities for sustainability: Toward a typology based on dimensions of sustainability-oriented innovation and stakeholder integration. *Business Strategy and the Environment*, *33*(4), 2969-3004. https://doi.org/10.1002/bse.3630

Piwowar-Sulej, K., Jarosz, S., Sołtysik, M., Ćwiklicki, M., & Wojnarowska, M. (2026). Understanding Circular Strategies: A Systematic Literature Review. *Business Strategy and the Environment*. https://doi.org/10.1002/bse.71156

Rane, J., Chaudhari, R. A., & Rane, N. L. (2025). Resilience and sustainability in supply chains through circular economy: Environmental impact, climate change mitigation, and waste management. *Enhancing sustainable supply chain resilience through artificial intelligence and machine learning: Industry 4.0 and Industry 5.0 in Manufacturing*, *111*. https://doi.org/10.2139/ssrn.5366938

Sehnem, S., Kuzma, E., Julkovsky, D. J., Frare, M. B., & Vazquez-Brust, D. (2021). Megatrends in circular economy: Avenues for relevant advancements in organizations. *Circular Economy and Sustainability, 1*, 1157–1193.

Setyadi, A., Pawirosumarto, S., & Damaris, A. (2025). Embedding circular operations in manufacturing: A conceptual model for operational sustainability and resource efficiency. *Sustainability*, *17*(15), 6737. https://doi.org/10.3390/su17156737

Singh, A., Payne, A. R., & Pal, R. (2026). From Compliance to Collaboration: Towards a Strategic Framework for Social Sustainability in Fashion Supply Chains—

Insights From a Two-Phase Literature Review. *Corporate Social Responsibility and Environmental Management*, *33*(2), 2783-2801. https://doi.org/10.1002/csr.70297

Theeraworawit, M., Suriyankietkaew, S., & Hallinger, P. (2022). Sustainable supply chain management in a circular economy: A bibliometric review. *Sustainability, 14*(15), 9304. https://doi.org/10.3390/su14159304

Vegter, D., Van Hillegersberg, J. O. S., & Olthaar, M. (2023). Performance measurement system for circular supply chain management. *Sustainable production and consumption*, *36*, 171-183. https://doi.org/10.1016/j.spc.2023.01.003

Zamani, E. D., Smyth, C., Gupta, S., & Dennehy, D. (2023). Artificial intelligence and big data analytics for supply chain resilience: a systematic literature review. *Annals of Operations Research*, *327*(2), 605-632. https://doi.org/10.1007/s10479-022-04983-y

Zhang, A., Wang, J. X., Farooque, M., Wang, Y., & Choi, T. M. (2021). Multi-dimensional circular supply chain management: A comparative review of the state-of-the-art practices and research. *Transportation Research Part E: Logistics and Transportation Review, 155*, 102509.